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*Shanghai CATIC OPTOELECTRONICS Co. Ltd*

# TFT COLOR LCD MODULE

（COMMON）

## TMS150XG1-14TB

## 38cm (15.0 Type)

## XGA

## LVDS Interface (1port)

# DATA SHEET

(Version 1.0)

***Published by***

Product Technology Department

**Shanghai CATIC OPTOELECTRONICS Co. Ltd**

| | |
|---|---|
| ***Approved by*** | ***Date*** |
| ***Checked by*** | ***Date*** |
| ***Prepared by*** | ***Date*** |

***Signature of customer***

| | |
|---|---|
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# INTRODUCTION

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2) Operation or use against specifications, instructions or warnings given by SCO
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The specifications of maintenance parts may be partially changed within equivalent quality or better. In this product, SCO will not accept to maintain for only mounting parts on circuit board (e.g. connector, fuse, capacitor, resistor, etc.) and only backlight conformation parts (e.g. reflector sheet, light guide plate, etc.).

If SCO is planning discontinuation for this product, SCO shall inform it to customers in six (6)-months advance from the issued date of official agreements. In addition, after product discontinuation, SCO may replace substitutes instead of maintenance parts with whole product.

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# CONTENTS

INTRODUCTION ..... 2
CONTENTS ..... 3
Record of Revision ..... 4
1. OUTLINE ..... 5
1.1 STRUCTURE AND PRINCIPLE ..... 5
1.2 APPLICATIONS ..... 5
1.3 FEATURES ..... 5
2. GENERAL SPECIFICATIONS ..... 6
3. BLOCK DIAGRAM ..... 7
4. DETAILED SPECIFICATION ..... 8
4.1 MECHANICAL SPECIFICATIONS ..... 8
4.2 ABSOLUTE MAXIMUM RATINGS ..... 8
4.3 ELECTRICAL CHARACTERISTICS ..... 9
4.4 POWER SUPPLY VOLTAGE SEQUENCE ..... 10
4.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS ..... 11
4.6 DISPLAY COLORS AND INPUT DATA SIGNALS ..... 14
4.7 DISPLAY POSITIONS ..... 15
4.8 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD ..... 15
4.9 OPTICS ..... 18
5. RELIABILITY TESTS ..... 21
6. ESTIMATED LUMINANCE LIFETIME ..... 22
7. MARKINGS ..... 23
7.1 PRODUCT LABEL ..... 23
7.2 BARCODE LABEL ..... 23
7.3 OTHER MARKINGS ..... 23
7.4 INDICATION LOCATIONS ..... 24
8. PACKING, TRANSPORTATION AND DELIVERY ..... 25
8.1 PACKING ..... 25
8.2 INSPECTION RECORD SHEET ..... 25
8.3 TRANSPORTATION ..... 25
8.4 SIZE AND WEIGHT FOR PACKING BOX ..... 25
8.5 OUTLINE FIGURE FOR PACKING ..... 26
9. PRECAUTIONS ..... 27
9.1 MEANING OF CUTION SIGNS ..... 27
9.2 CAUTIONS ..... 27
9.3 ATTENTIONS ..... 27
10.OUTDRAWING ..... 29

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# Record of Revision

| Rev | Issued Date | Description | Editor |
|---|---|---|---|
| 1.0 | 2009-12-22 | Preliminary Release | |
| | | | |

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# 1. OUTLINE

## 1.1 STRUCTURE AND PRINCIPLE

TMS150XG1-14TB module is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight.

The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays.

The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

## 1.2 APPLICATIONS

• Monitor for PC（for amusement or industry）

## 1.3 FEATURES

- a-Si TFT active matrix
- LVDS interface (6 bit+FRC or 6bit)
- Wide viewing angle
- high response time : 8ms (typ.)
- PSWG standard
- High contrast: 600:1(typ.)
- Edge light type backlight
- For high temperature application
- RoHS compliance
- TCO'03 compliance

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## 2. GENERAL SPECIFICATIONS

| | |
|---|---|
| ***Display area*** | 304.128 (W) x 228.096 (H) mm (typ.) |
| ***Diagonal size of display*** | 38.0 cm (15.0 inches) |
| ***Drive system*** | a-Si TFT active matrix |
| ***Display color*** | 16,777,216 colors (6bit+FRC or 6 bit) |
| ***Pixel*** | 1,024 (H) x 768 (V) pixels |
| ***Pixel arrangement*** | RGB (Red dot、Green dot、 Blue dot) vertical stripe |
| ***Dot pitch*** | 0.099 (W) x 0.297 (H) mm |
| ***Pixel pitch*** | 0.297 (W) x 0.297 (H) mm |
| ***Module size*** | 326.50±0.5 (W) x 253.5±0.5 (H) x 11.13±0.5 (D) mm (typ.) |
| ***Weight*** | 1000 g (typ.) |
| ***Contrast ratio*** | 600:1 (typ.) |
| ***Viewing angle***<br>*(At the contrast ratio 10：1)* | • Horizontal: 160° (typ.)<br>• Vertical: 160° (typ.) |
| ***Designed viewing direction*** | • Viewing angle with optimum grayscale ( γ =2.2): normal axis |
| ***Color gamut*** | *At LCD panel center*<br>60 % (typ.) [against NTSC color space] |
| ***Response time*** | *Ton (white 90%→black 10%) + Toff (black 10%→white 90%)*<br>8 ms (typ.) |
| ***Luminance*** | *At IBL = 7mArms / lamp*<br>350cd/m$^2$ (typ.) |
| ***Transmissive Mode*** | Normally White |
| ***Surface Treatment*** | AG Type |
| ***Signal system*** | LVDS 1port<br>[ RGB :8-bit, Dot clock (CLK), Data enable (DE)] |
| ***Power supply voltage*** | LCD panel signal processing board：3.3V |
| ***Backlight*** | Edge light type：2 cold cathode fluorescent lamps |
| ***Power consumption*** | *At IBL=7mArms / lamp and checkered flag pattern*<br>(10.1 )W (typ.) |

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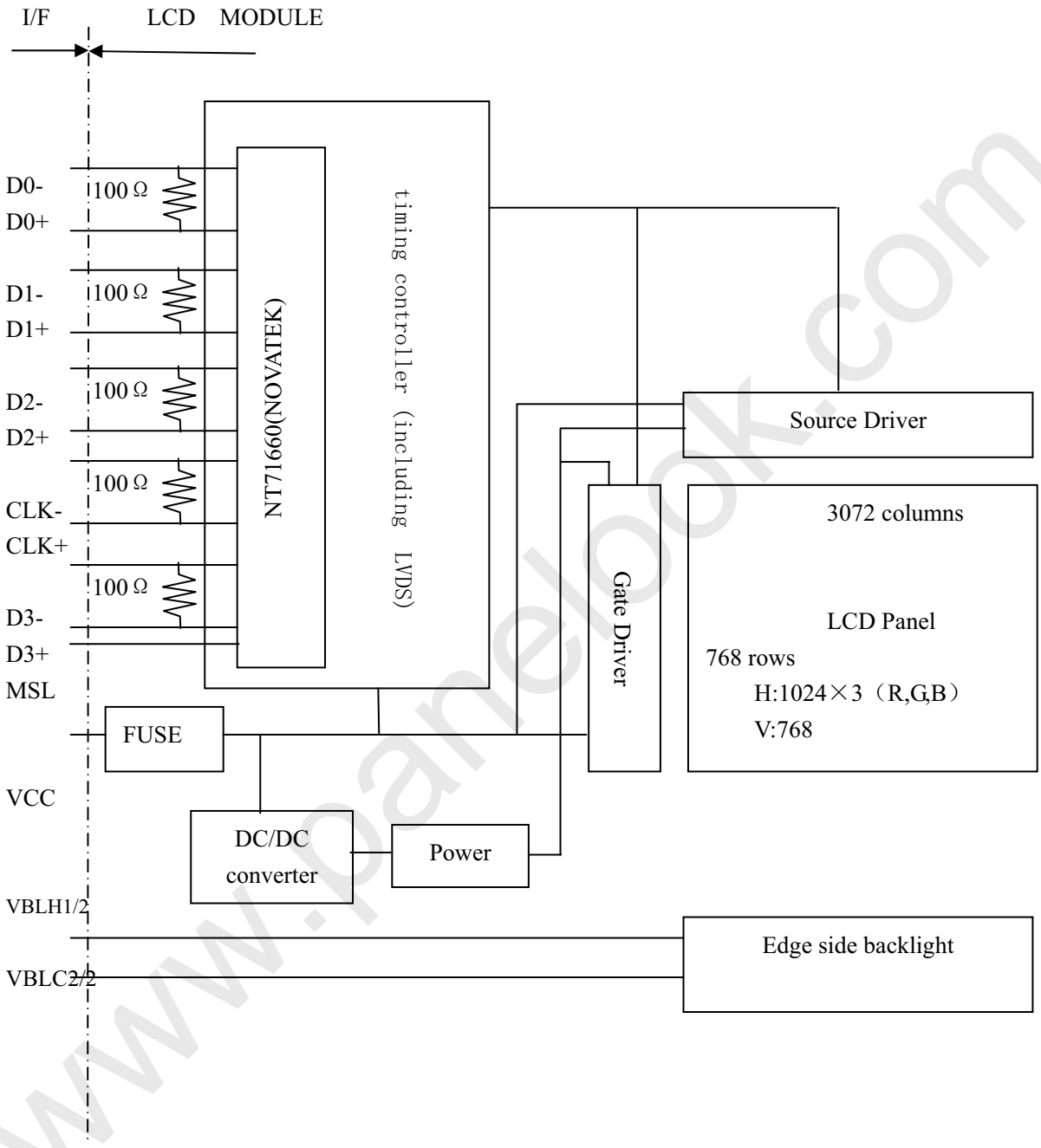
## 3. BLOCK DIAGRAM




Note1: Connections between GND, FG (Frame ground) and VBLC (Lamp low voltage terminal) in the product

| | |
|---|---|
| GND - FG | Connected |
| GND - VBLC | Not connected |
| FG - VBLC | Not connected |

Note2: These grounds should be connected together in customer equipment.

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# 4. DETAILED SPECIFICATION

## 4.1 MECHANICAL SPECIFICATIONS

| Parameter | Specification | Unit |
|---|---|---|
| Module size | 326.5±0.5 (W) x 253.5±0.5 (H) x 11.13±0.5 (D) Note1 | mm |
| Display area | 304.128 (W) x 228.096 (H) Note1 | mm |
| Weight | 1000 (typ.) | g |

Note1: See "**10. OUTLINE DRAWINGS**".

## 4.2 ABSOLUTE MAXIMUM RATINGS

| Parameter | | Symbol | Rating | Unit | Remarks |
|---|---|---|---|---|---|
| Power supply voltage | LCD panel signal board | VCC | -0.3 to +3.6 | V | Ta = 25℃ |
| Input voltage for signals | Display signals | Vi | -0.3 to +3.6 and Vi<VCC +0.3 | V | Ta = 25℃ |
| | Function signals | | | | |
| Storage temperature | | Tst | （-30~80） | ℃ | - |
| Operating temperature | | Top | （-20~70） | ℃ | - |
| Relative humidity Note1 | | RH | （≤ 95） | % | Ta ≤ 40℃ |
| | | | （≤ 80） | % | 40 <Ta ≤70℃ |

Note1: No condensation

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## 4.3 ELECTRICAL CHARACTERISTICS

### 4.3.1 Driving for LCD panel signal processing board

| Parameter | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Power supply voltage | | VCC | 3.0 | 3.3 | 3.6 | V | - |
| Power supply current | | ICC | - | (400)※1 | (600)※2 | mA | at VCC = 3.3V |
| Permissible ripple voltage | | VRP | - | - | 100 | mV | For VCC |
| Differential input threshold voltage for LVDS receiver | Low | VTL | -100 | - | | mV | at VCM = 1.2V Note3 |
| | High | VTH | - | - | 100 | mV | |
| Input voltage width for LVDS receiver | | Vi | 0 | - | 2.4 | V | - |
| Terminating resistor | | RT | - | 100 | - | Ω | - |
| Input voltage for MSL signal | Low | VFL | 0 | - | 0.8 | V | - |
| | High | VFH | 2.0 | - | VCC | V | |

※1: Checkered flag pattern (EIAJ ED-2522)； ※2: 2H1V dot inverse pattern

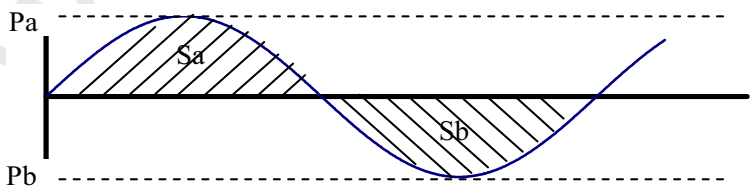
※3: Common mode voltage for LVDS receiver

### 4.3.2 Driving for backlight lamp

| Parameter | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|
| Lamp current | Il | (3.5) | (7.0) | (7.5) | mArms | Ta = 25℃ |
| Lamp voltage | Vl | (558) | (620) | (682) | Vrms | Il=7.0mA, Ta = 25℃ |
| Lamp starting voltage Note1 | VS | - | - | (1600) | Vrms | Ta = 0℃ Note2 |
| | | - | - | (1100) | Vrms | Ta = 25℃ Note2 |
| Oscillation frequency | FO | 40 | 50 | 60 | kHz | Note3 |

Note1: The value is the characteristic of each lamp. The starting voltage of inverter should be lower than the value. But the possibility of not lighting exists by the lower voltage, so the suitable voltage should considered by the test .

Note2: The asymmetric ratio of working waveform for lamps (Lamp voltage peak ratio, Lamp current peak ratio and waveform space ratio) should be less than 5% (See the following figure). If the waveform is asymmetric, DC (Direct current) element applies into the lamp. In this case, a lamp lifetime may be shortened, because a distribution of a lamp enclosure substance inclines toward one side between low voltage terminal (Cold terminal) and high voltage terminal (Hot terminal).




$|Pa - Pb| / Pb \times 100 \leqslant 5\%$

$|Sa - Sb| / Sb \times 100 \leqslant 5\%$

Pa: Supply voltage/current peak for positive, Pb: Supply voltage/current peak for negative

Sa: Waveform space for positive part, Sb: Waveform space for negative part

Note3: Recommended value of "FO" is as following.

FO = 1/4 x 1/th x (2n-1) n: Natural number (1, 2, 3 ……)

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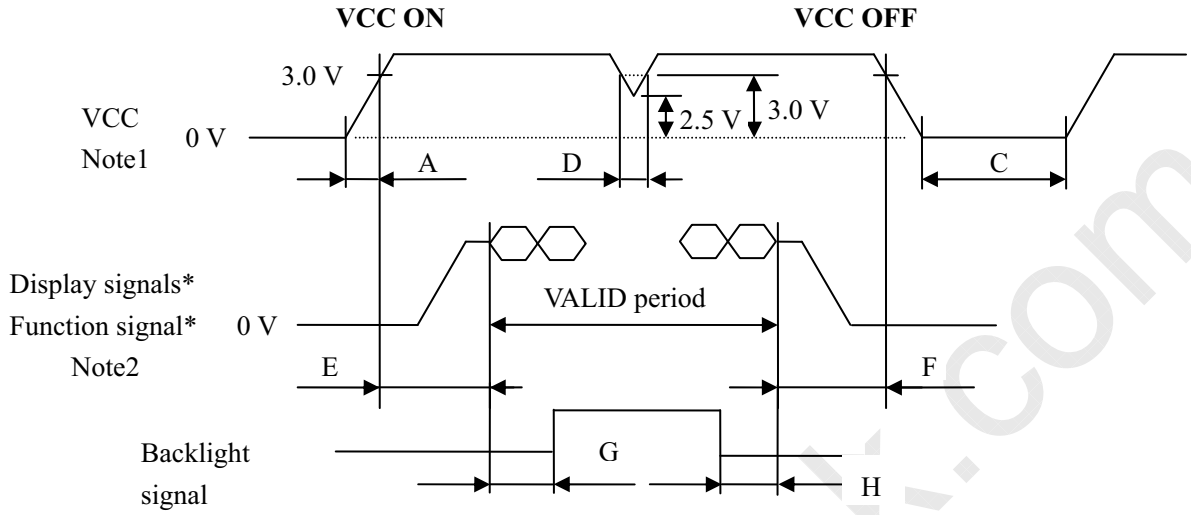
## 4.4 POWER SUPPLY VOLTAGE SEQUENCE

### 4.4.1 The sequence of backlight and power supply




* These signals should be measured at the terminal of 100Ω resistor.

| Parameter | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|
| Input voltage sequence | ON | A | - | - | 10 | ms | - |
| | Moment | C | 500 | - | - | ms | - |
| | DIP | D | - | - | 20 | ms | ※1 |
| Power supply and signal sequence | ON | E | 0.01 | - | 50 | ms | - |
| | OFF | F | 0.01 | - | 50 | ms | - |
| B/L igniting | ON | G | 200 | - | - | ms | PSWG |
| B/L extinguishing | OFF | H | 200 | - | - | ms | - |

※ 1: VCC should be 2.5 V or more while VCC ON period.

[NOTE ITEM]

Note1: In terms of voltage variation (voltage drop) while VCC rising edge is below 3.0 V, a protection circuit may work, and then this product may not work.

Note2: Display signals (D0+/-, D1+/-, D2+/-, D3+/- and CK+/-) and function signal (MSL) must be "0" voltage, exclude the VALID period (See above sequence diagram). If these signals are higher than 0.3 V, the internal circuit is damaged.

If some of display and function signals of this product are cut while this product is working, even if the signal input to it once again, it might not work normally. If customer stops the display and function signals, they should be cut VCC.

Note3: The backlight power supply voltage should be inputted within the valid period of display and function signals, in order to avoid unstable data display.

Note4: In order to prevent unstable data displaying, suggest that, during display and function signal's valid period, backlight power voltage should be input under the custom ' condition as possible.

### 4.4.2 Power supply voltage ripple

This product works, even if the ripple voltage levels are beyond the permissible values as the following table, but there might be noise on the display image.

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| Parameter | Power supply voltage | Ripple voltage Note1 (Measured at input terminal of power supply) | Unit |
|---|---|---|---|
| VCC | 3.3 V | ≤ 100 | mVp-p |

Note1: The permissible ripple voltage includes spike noise.

4.4.3 Fuse

| Parameter | Fuse | | Rating | Fusing current | Remarks |
|---|---|---|---|---|---|
| | Type | Supplier | | | |
| VCC | TF16SN2.50 | KOA Corporation | 1.5 A<br>32 V | 5.0 A | Note1 |

Note1: The power supply capacity should be more than the fusing current. If the power supply capacity is less than the fusing current, the fuse may not blow for a short time, and then nasty smell, smoking and so on may occur.

## 4.5 CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

4.5.1 LCD panel signal processing board

CN1 socket(Module side): DF-14H-20P-1.25H（Hirose Electric Co., Ltd.）

Adaptable plug: DF14-20S-1.25C（Hirose Electric Co., Ltd.）

| Pin No. | Symbol | Signal | Remarks |
|---|---|---|---|
| 1 | VCC | Power supply | - |
| 2 | VCC | | |
| 3 | GND | Ground | - |
| 4 | GND | | |
| 5 | D0- | Pixel data | Note2 |
| 6 | D0+ | | |
| 7 | GND | Ground | - |
| 8 | D1- | Pixel data | Note2 |
| 9 | D1+ | | |
| 10 | GND | Ground | - |
| 11 | D2- | Pixel data | Note2 |
| 12 | D2+ | | |
| 13 | GND | Ground | - |
| 14 | CLK- | Pixel clock | Note2 |
| 15 | CLK+ | | |
| 16 | GND | Ground | - |
| 17 | D3- | Pixel data | Note2 |
| 18 | D3+ | | |
| 19 | GND | Ground | - |
| 20 | MSL | Selection for 6bits/8bits | Note1 |

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Note1：See**"4.5.4 Connection between receiver and transmitter For LVDS" .**

Note2：Twist pair wires with 100Ω(Characteristic impedance) should be connected between LCD panel signal processing board and LVDS transmitter.

### 4.5.2 Backlight lamp

**Attention: VBLH and VBLC must be connected correctly. IF customer connects wrongly, customer will be hurt and the product will be broken.**

CN201 plug（LCD module side）：BHR-03VS-1（J.S.T Mfg. Co., Ltd.）

Adaptable socket： SM02（8.0）B-BHS-1-TB（J.S.T Mfg. Co., Ltd.）

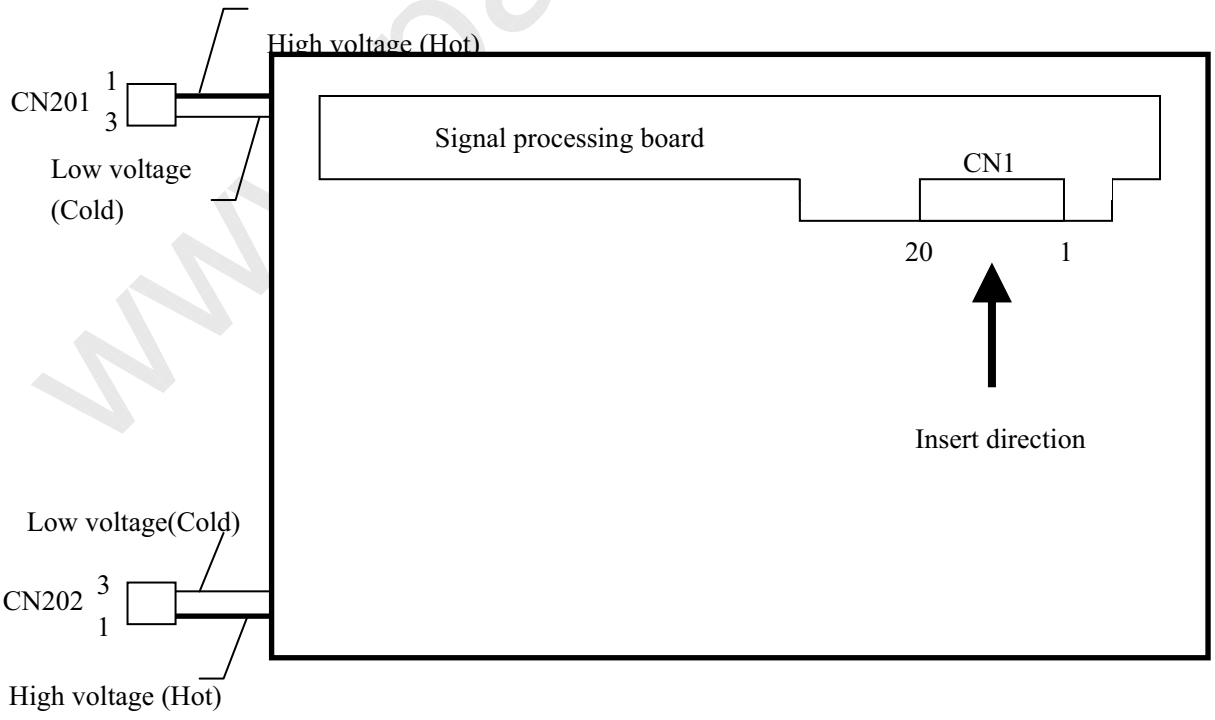
| Pin No. | Symbol | signal | remarks |
|---|---|---|---|
| 1 | VBLH | High voltage terminal(Hot) | Cable color: (Sky)Blue |
| 2 | N.C | - | - |
| 3 | VBLC | Low voltage terminal(Cold) | Cable color: White |

CN202 plug（LCD module side）：BHR-03VS-1（J.S.T Mfg. Co., Ltd.）

Adaptable socket： SM02（8.0）B-BHS-1-TB（J.S.T Mfg. Co., Ltd.）

| Pin No. | Symbol | signal | remarks |
|---|---|---|---|
| 1 | VBLH | High voltage terminal(Hot) | Cable color: (Sky)Blue |
| 2 | N.C | - | - |
| 3 | VBLC | Low voltage terminal(Cold) | Cable color: White |

### 4.5.3 Position of plugs and a socket

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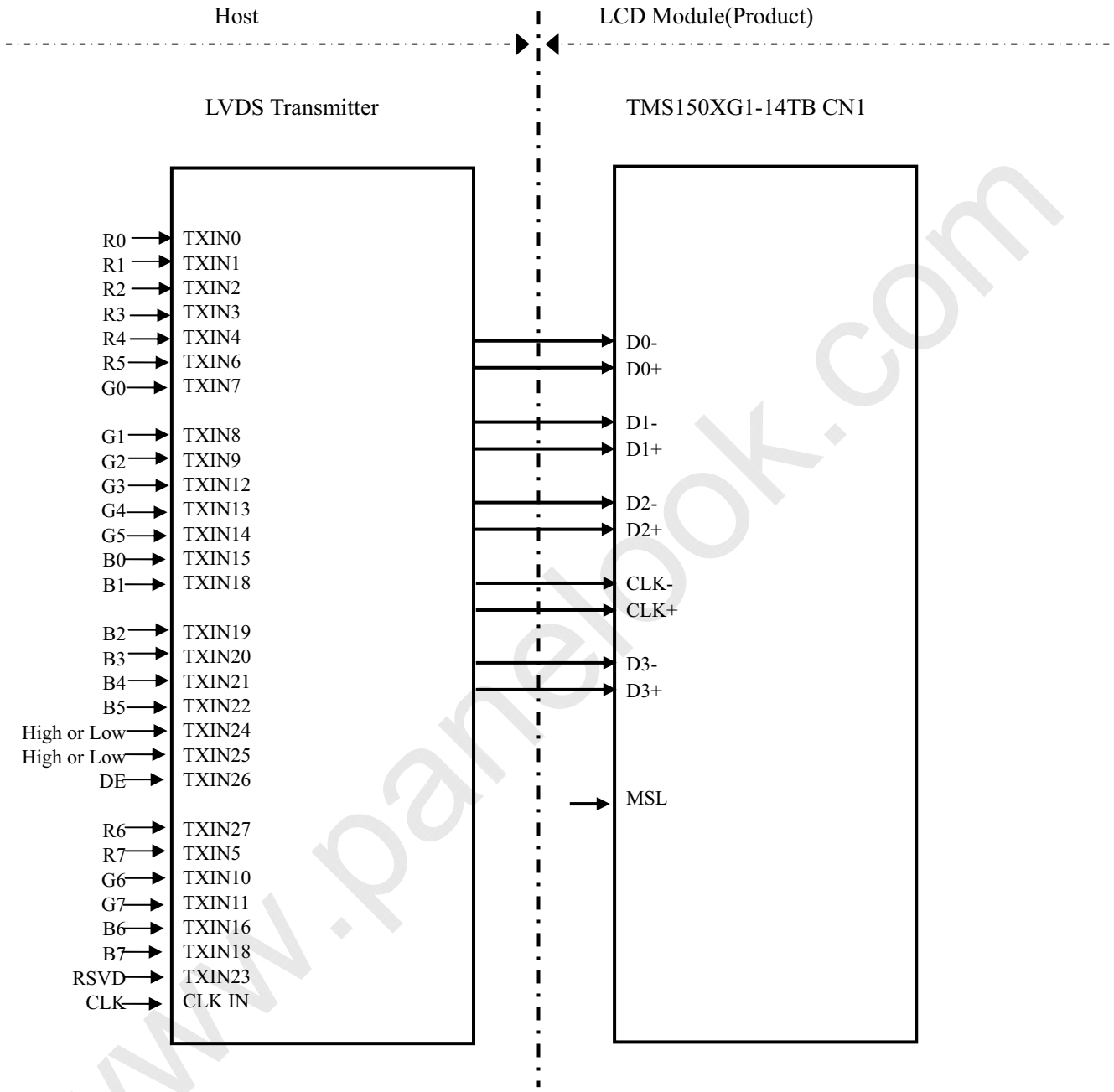
4.5.4 Connection between receiver and transmitter for LVDS

Input LVDS map (MSL :"Low"or"Open")




Note1: Recommended transmitter

See the data sheet for DS90C383（National Semiconductor）.

Note2: MSL="Low" is 8 bits mode ; MSL= "High" is 6 bits mode

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## 4.6 DISPLAY COLORS AND INPUT DATA SIGNALS

This product can display in equivalent to 16.7Mcolors in 256 scale or 262K colors in 64 scale. The relation between display colors and input data signals(6bit + FRC) is as the following table .

| Display colors | | Data signal （0:Low level，1:High Level） | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Magenta | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Cyan | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Yellow | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | White | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Red grayscale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Red | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Green grayscale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Green | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blue grayscale | Black | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Dark | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| | ↑ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | ↓ | | | | : | | | | | | | | : | | | | | | | | : | | | | |
| | Bright | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 |
| | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Blue | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

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## 4.7 DISPLAY POSITIONS

The following table is the coordinates per pixel

C（1，1）

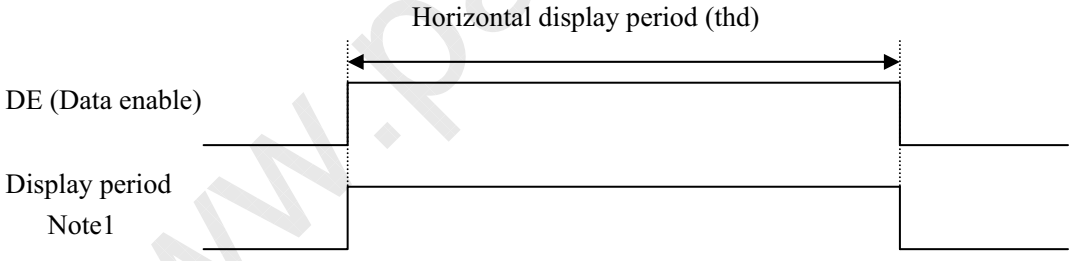
| R | G | B |
|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| C（1，1） | C（2，1） | ••• | C（X，1） | ••• | C（1023，1） | C（1024，1） |
| C（1，2） | C（2，2） | ••• | C（X，Y） | ••• | C（1023，2） | C（1024，2） |
| • • • | • • • | • ••• • | • • • | • ••• • | • • • | • • • |
| C（1，Y） | C（2，Y） | ••• | C（X，Y） | ••• | C（1023，Y） | C（1024，Y） |
| • • • | • • • | • ••• • | • • • | • ••• • | • • • | • • • |
| C（1，767） | C（2，767） | ••• | C（X，767） | ••• | C（1023，767） | C（1024，767） |
| C（1，768） | C（2，768） | ••• | C（X，768） | ••• | C（1023，767） | C（1024，768） |

## 4.8 INPUT SIGNAL TIMINGS FOR LCD PANEL SIGNAL PROCESSING BOARD

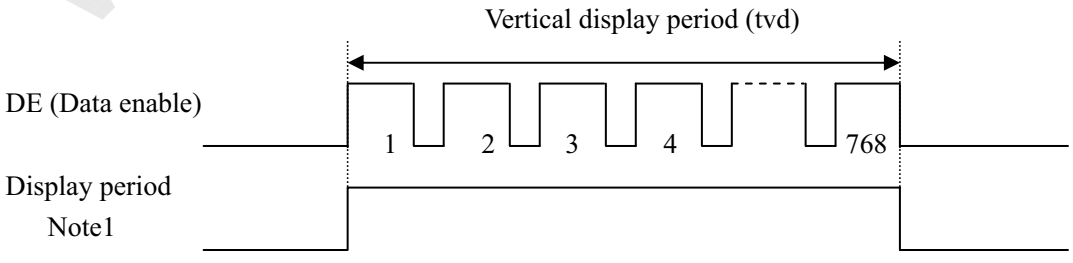
4.8.1 Outline of input signal timings

• Horizontal signal




Note1: This diagram indicates virtual signal for set up to timing.

• Vertical signal




Note1: This diagram indicates virtual signal for set up to timing.

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4.8.2 Timing characteristics

(Note1)

| Parameter | | | Symbol | min. | typ. | max. | Unit | Remarks |
|---|---|---|---|---|---|---|---|---|
| CLK | Frequency | | 1/tc | 60.0 | 65.0 | 70.0 | MHz | 15.384ns（typ.） |
| | Duty | | — | — | | | — | Note2 |
| | Rise time, Fall time | | — | | | | ns | |
| DE | Horizontal | Cycle | th | 12.3 | 20.676 | 30.00 | μs | 48.363KHz(typ.) |
| | | | | 1050 | 1344 | 1800 | CLK | Note3<br>Note4 |
| | | Display period | thd | 1024 | | | | — |
| | Vertical (One frame) | Cycle | tv | 13.1 | 16.666 | 20.0 | ms | 60.0Hz（typ.） |
| | | | | 770 | 806 | 1334 | H | |
| | | Display period | tvd | 768 | | | H | |
| | CLK-DE | Setup time | — | — | | | ns | Note2 |
| | | Hold time | — | | | | ns | |
| | Rise time, Fall time | | — | | | | ns | |

Note1： Definition of parameters is follows.
tc=1CLK,Th=1H

Note 2：See the data sheet of LVDS transmitter.

Note 3：Both of “time” and “CLK number” of the “th” must keep the Minimum value of specifications.

Note 4：“th” must keep the fluctuation within ±1 CLK, because of avoidance of image sticking.

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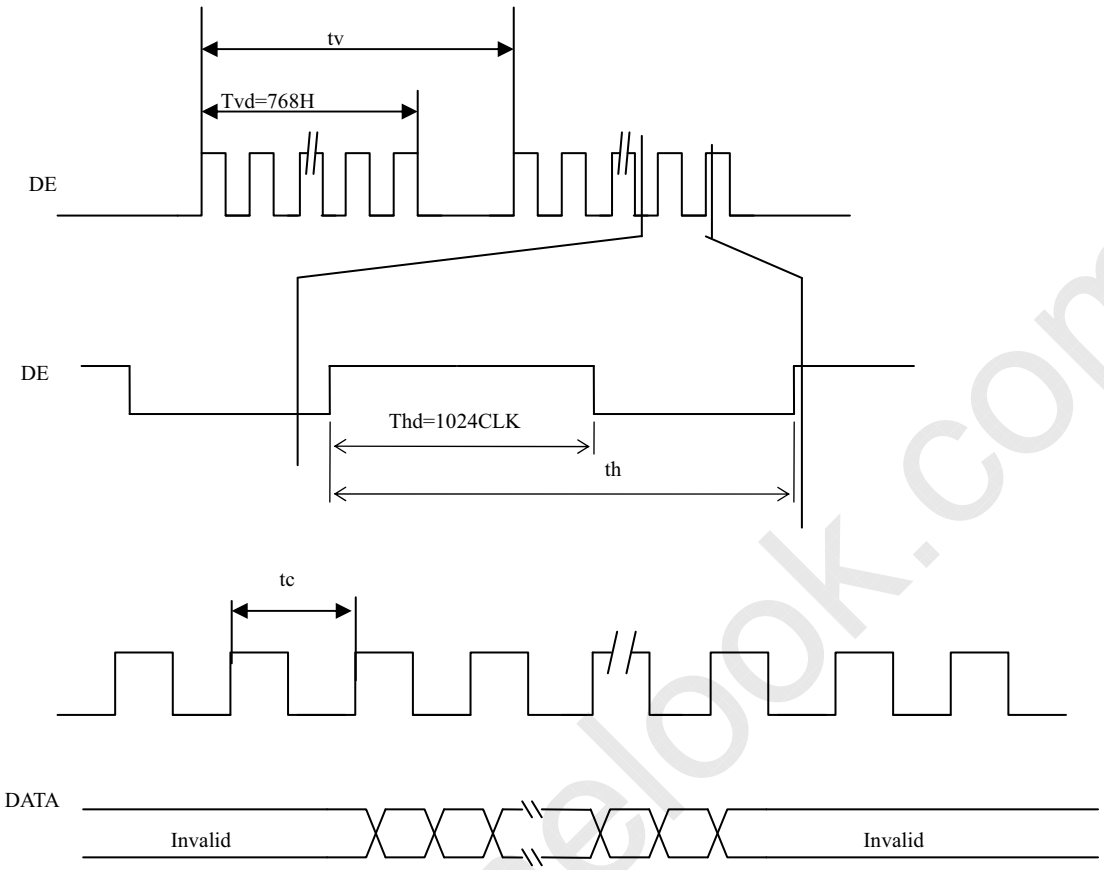
4.8.3 Input signal timing chart

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## 4.9 OPTICS

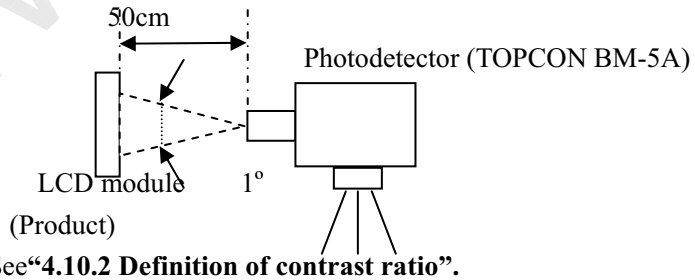
### 4.9.1 Optical characteristics

| Parameter Note1 | | Condition | Symbol | min. | typ. | max. | Unit |
|---|---|---|---|---|---|---|---|
| Luminance | | White at center R=0, L=0, U=0,D=0 | L | (250) | (350) | - | cd/ $m^2$ |
| Contrast ratio | | White/Black at center R=0， L=0, U=0,D=0 | CR | 400 | 600 | - | - |
| Luminance uniformity | | - | LU | - | 1.2 | 1.3 | - |
| Chromaticity | White | X coordinate | Wx | 0.283 | 0.313 | 0.343 | - |
| | | Y coordinate | Wy | 0.299 | 0.329 | 0.359 | - |
| | Red | X coordinate | Rx | 0．60 | 0．63 | 0．66 | - |
| | | Y coordinate | Ry | 0．31 | 0.34 | 0．37 | |
| | Green | X coordinate | Gx | 0．27 | 0.30 | 0．33 | - |
| | | Y coordinate | Gy | 0．54 | 0.57 | 0．60 | - |
| | Blue | X coordinate | Bx | 0．11 | 0.14 | 0．17 | - |
| | | Y coordinate | By | 0．07 | 0.10 | 0．13 | - |
| Color gamut | | R=0, L=0, U=0,D=0 | C | 50 | 60 | - | % |
| Response time | | White to black | Ton | - | 2 | 4 | ms |
| | | Black to white | Toff | - | 6 | 8 | ms |
| Viewing angle | Right | θU=0°, θD=0°,CR=10 | θR | 70 | 80 | - | 。 |
| | Left | θU=0°, θD=0°,CR=10 | θL | 70 | 80 | - | 。 |
| | Up | θR=0°, θL=0°,CR=10 | θU | 70 | 80 | - | 。 |
| | Down | θR=0°, θL=0°,CR=10 | θD | 70 | 80 | - | 。 |

Note1： Measurement conditions are follows.

Ta=25C，VCC=3.3V，IBL=7mArms/lamp，Display mode：XGA，Horizontal cycle=48.363 KHz，Vertical cycle=60.000Hz

Optical characteristics are measured at luminance saturation after 20minutes from working the product, in the dark room. Also measurement method for luminance is as follows.




Note 2： See**“4.10.2 Definition of contrast ratio”.**

Note 3： See**“4.10.3 Definition of luminance uniformity”.**

Note 4： Ambient temperature： Top=25.0℃

Note 5： See **“4.10.4 Definition of response times”.**

Note 6： See **“4.10.5 Definition of viewing angles”.**

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4.9.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

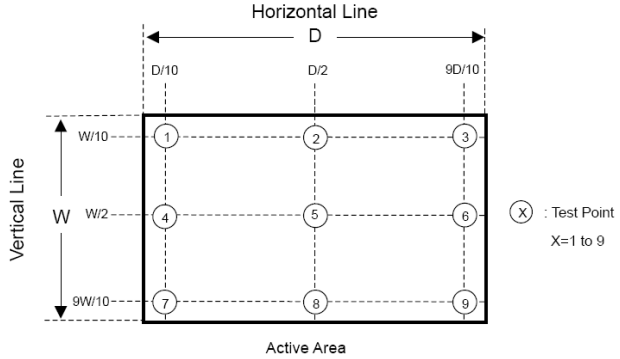
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

4.9.3 Definition of luminance uniformity

The luminance uniformity is calculated by using the following formula.

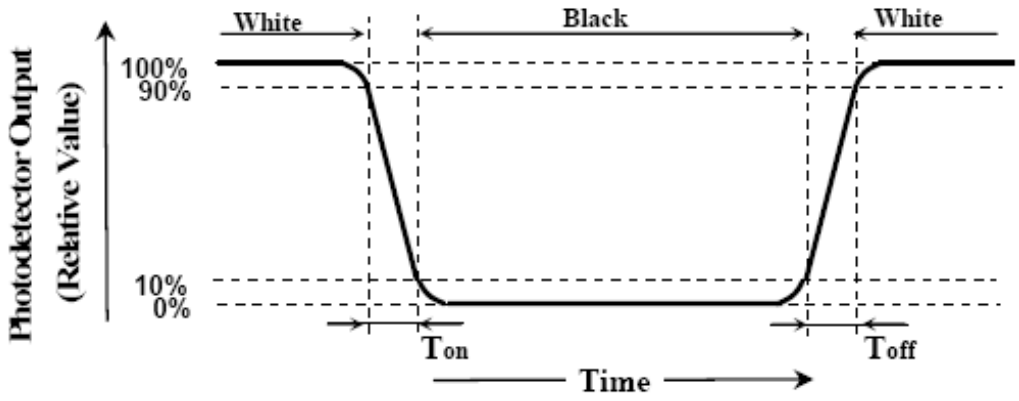
$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.




4.9.4 Definition of response times

Response time is measured, the luminance changes from “white” to “black”, or “black” to “white” on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90%. (See the following diagram.)

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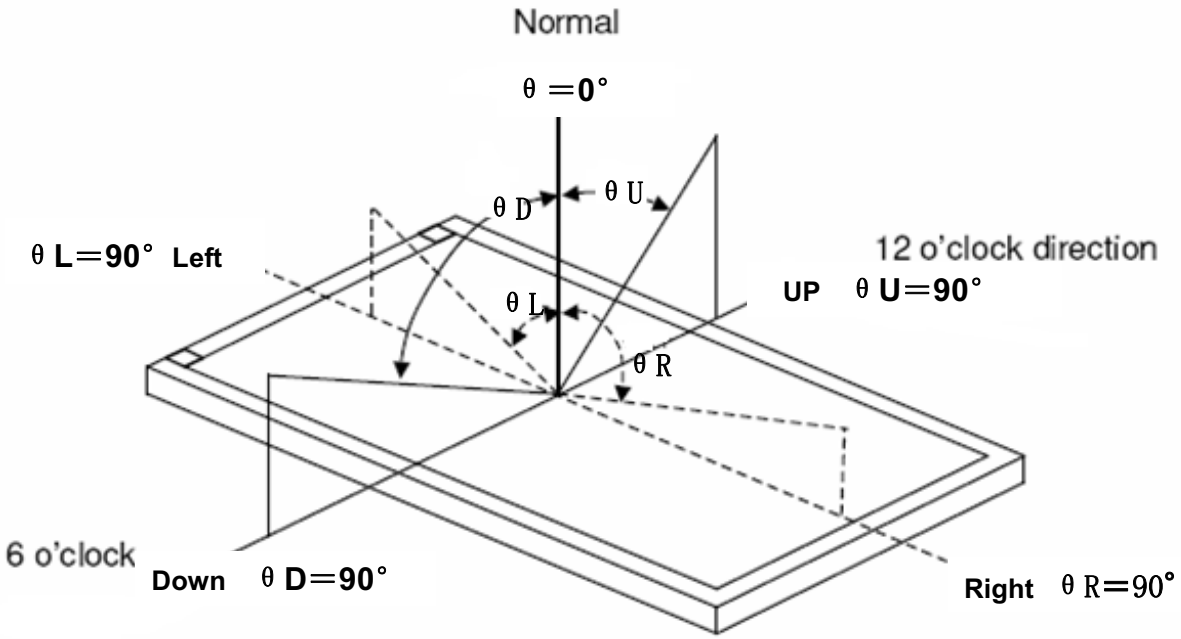
4.9.5 Definition of viewing angles

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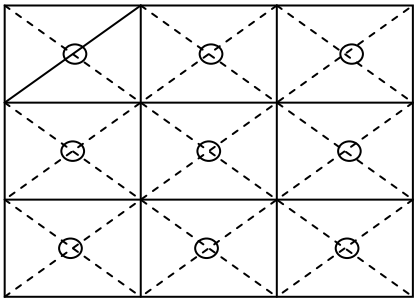
## 5. RELIABILITY TESTS

| Test item | | Condition | Judgement Note1 |
|---|---|---|---|
| High temperature and humidity(Operation) | | ① (70±2℃,RH=80%,240hours)<br>② Display data is black | No display malfunctions |
| Low temperature (Operation) | | ① (-20±3℃...240hours)<br>② Display data is black | |
| Thermal shock (Non operation) | | ① （ -30±3℃...30minutes 80±3℃ ...30minutes）<br>② 100cycles,1hour/cycle<br>③ Temperature transition time is within 5 minutes. | |
| ESD (operation) | | ① 150Pf,150Ω,±10kV<br>② 9 places on a panel surface<br>③10 times each places at 1 sec interval | |
| Vibration (Non operation) | | ① 5-100Hz，sine wave,11.76m/S$^2$<br>② 1 minutes/cycle<br>③ X,Y,Z direction<br>④ 50 times each directions | No display malfunctions<br>No physical damages |
| Mechanical shock (Non operation) | | ① 294m/S$^2$，11ms<br>② ±X，±Y，±Z direction<br>③ 3 times each directions | |
| Low pressure | operation | ①53.3kPa (Equivalent to altitude 4,850m）<br>② 0℃±3℃...24hours<br>③ 50℃±3℃...24hours | No display malfunctions |
| | non-operation | ① 15kPa (Equivalent to altitude 13,600m）<br>② -20℃±3℃...24hours<br>③ 60℃±3℃... 24hours | |

Note1: Display and appearance are checked under environmental conditions equivalent to the inspection conditions of defect criteria.

Note2: See the following figure for discharge points.



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# 6. ESTIMATED LUMINANCE LIFETIME

The luminance lifetime is the time from initial luminance to half-luminance.

**This lifetime is the estimated value, and is not guarantee value.**

| Condition | Luminance lifetime(MTTF) **Note1** | Unit |
|---|---|---|
| 25℃(Ambient temperature of the product) Continuous operation and IBL=7.0mArms/lamp | (50,000(Typ)) | Hours |

Note1: MTTF is mean time to half-luminance. In case the product works under low temperature environment, the lifetime becomes short.

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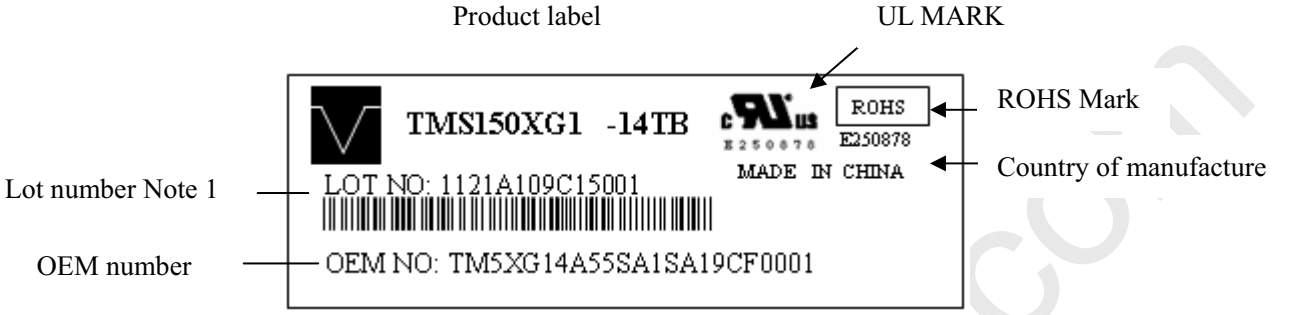
# 7. MARKINGS

The various markings are attached to this product. See "7.4 INDECATION LOCATIONS" for attachment positions.

## 7.1 PRODUCT LABEL




Note1: The meaning of lot number

•Example: 11A6A108909005

| 11A6A1 | 08 | 9 | 09 | 005 |
|---|---|---|---|---|
| Internal use | Manufacturing year 2 figures of the A.D. end numbers (e.g: A.D2004 is 04.) | Manufacturing month 1 letter | Manufacturing day | Production number Multi-letter (figure) |

Jan. to Sep.: Number of month
October: A
November: B
December: C

Note2: **Do not attach anything such as label and so on, on the product label**! In case repair the product, SCO needs the contents of product label such as the lot number, inspection date and so on, to identify the warranty period with individual product. If SCO cannot decipher the contents of product label, such repair shall be entitled to charge. Also SCO may give a new lot number to reconditioned products.

## 7.2 BARCODE LABEL

## 7.3 OTHER MARKINGS

High voltage caution marking

Disposal method marking for lamp

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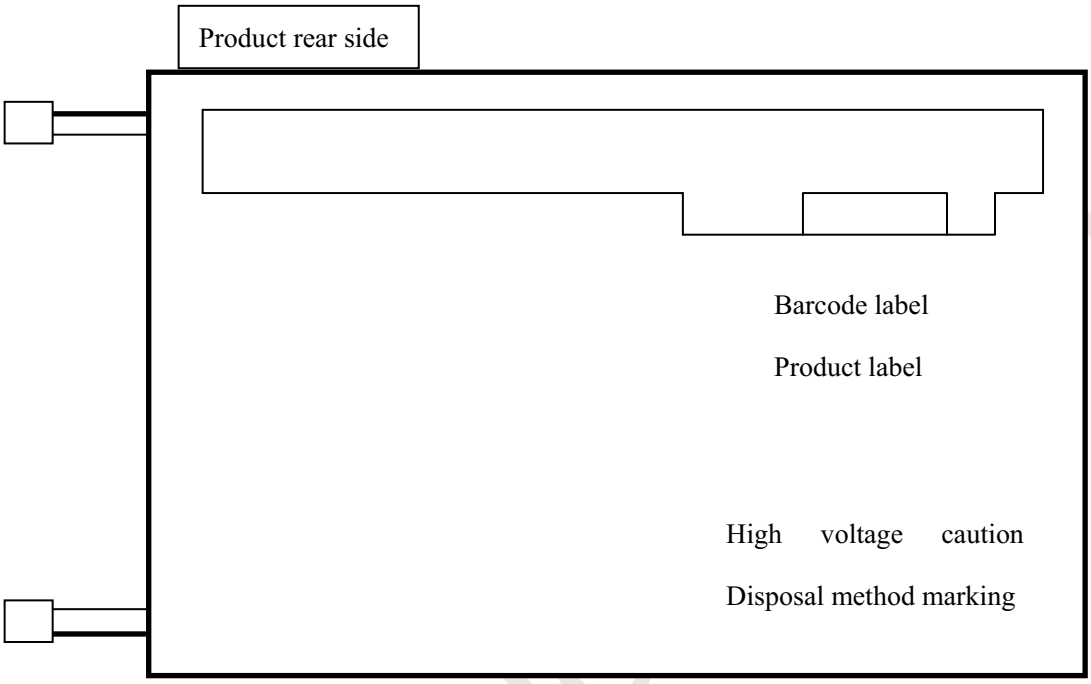
## 7.4 INDICATION LOCATIONS

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# 8. PACKING, TRANSPORTATION AND DELIVERY

SCO will pack products to deliver to customer in accordance with SCO packing specifications, and will deliver products to customer in such a state that products will not suffer from a damage during transportation .The delivery conditions are as follows.

## 8.1 PACKING

(1) Packing box

14 products are packed up with the maximum in a packing box(See "**8.5 OUTLINE FIGURE FOR PACKING** ").

Products are put into a plastic bag for prevention of moisture with cushion, and then the bag is sealed up with heat sealing.

The type name and quality are shown on outside of the packing box, either labeling or printing.

(2)Pallet Packing (See" **8.5 OUTLINE FIGURE FOR PACKING** ")

① Packing boxes are tired on a cardboard pallet.(9 boxes×4 tiers maximum)

②Cardboard sleeve and top cap are attached to the packing boxes, then they are fixed by a band.

## 8.2 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with delivery products to customer. It is summarized to a number of products for pass/fail assessment.

## 8.3 TRANSPORTATION

The product is transported by vehicle, aircraft or shipment in the state of pallet packing.

## 8.4 SIZE AND WEIGHT FOR PACKING BOX

| Parameter | Packing box | Unit |
|---|---|---|
| Size | 378（L）x368（W）x315.5（H）（typ.） | mm |
| Weight | 1（typ.） | kg |
| Total weight | 14.6（typ.）<br>(with 14 products) | kg |

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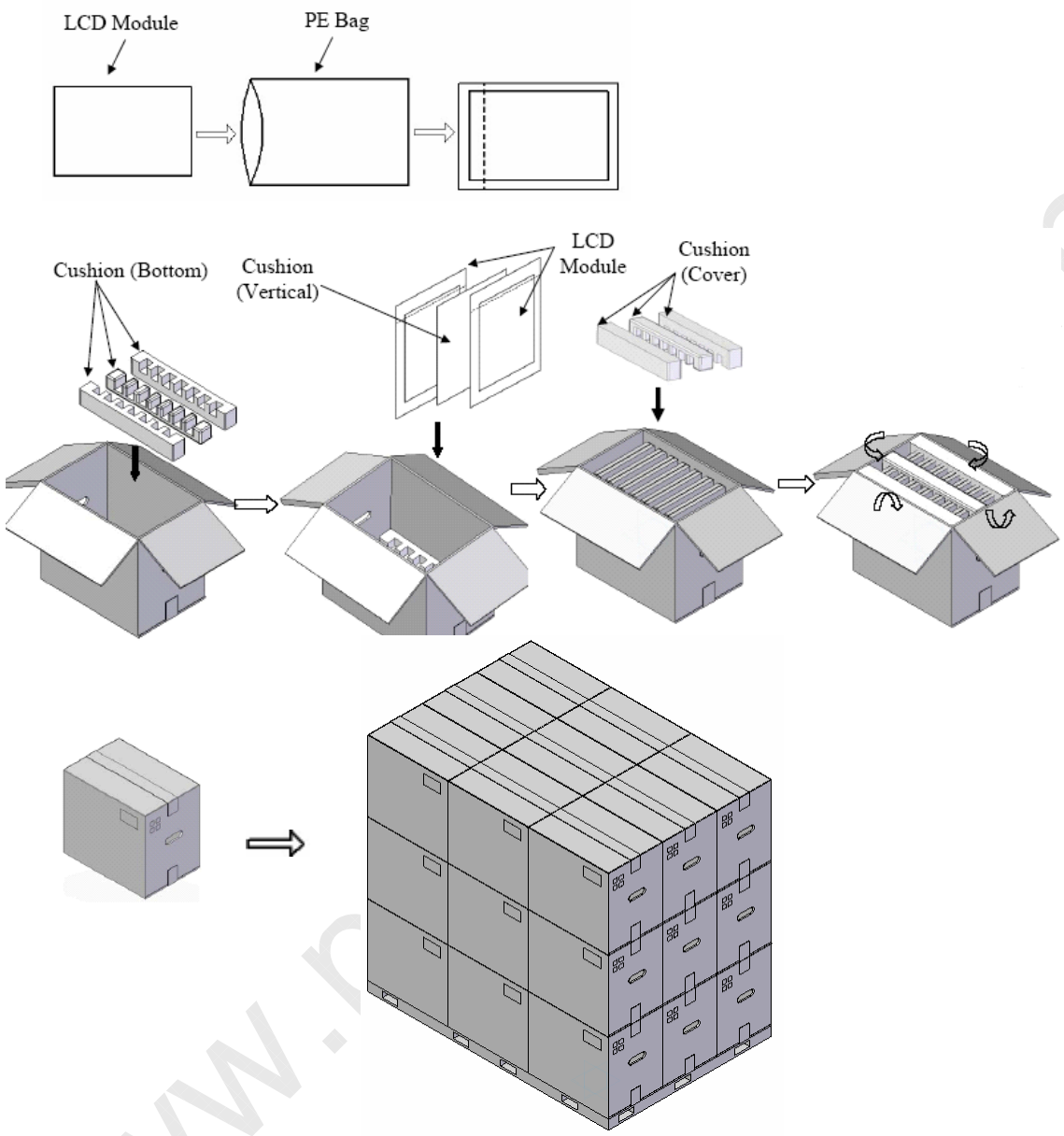
## 8.5 OUTLINE FIGURE FOR PACKING

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# 9. PRECAUTIONS

## 9.1 MEANING OF CUTION SIGNS

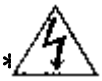
The following caution signs have very important meaning .**Be sure to read "9.2 CAUTIONS" and "9.3 ATTENTIONS", after understanding these contents!**

This sign have the meaning that customer will be injured by himself or the product will sustain a damage, if customer has wrong operations.

This sign has the meaning that customer will get an electrical shock, if customer has wrong operations.

This sign has the meaning that customer will be injured by himself, if customer has wrong operations.

## 9.2 CAUTIONS



**t touch lamp cables while turn on .Customers will be in danger of an electric shock**

*** Do not touch the working backlight and IC. Customers will be in danger of burn injury.**

*** Do not shock and press the LCD panel and the backlight! There is a danger of breaking, because they are made of glass.(shock :To be not greater 294m/s$^2$ and to be not greater 11ms, Pressure: To be not greater 19.6N)**

## 9.3 ATTENTIONS

9.3.1 Handling of the product

① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.

② Do not hook cables nor pull connection cables such as flexible cable and so on , for fear of damage.

③ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.

④ Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deal with the product, because products may be damaged by electrostatic.

⑤The torque for mounting screws must never exceed 0.34N-m. Higher torque values might result in distortion of the bezel.

⑥The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings).And do not add undue stress to any portion (such as bezel flat area) except mounting hole portion. Bends or twist described above and undue stress to any portion except mounting hole portion may cause display

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un-uniformity.

⑦Do not press or rub on the sensitive display surface .If customer clean on the panel surface, SCO recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.

⑧ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.

⑨ Do not bend or unbend the lamp cable at the near part of the lamp holding rubber, to avoid the damage for high voltage side of the lamp. This damage may cause a lamp breaking and abnormal operation of high voltage circuit.

### 9.3.2 Environment

① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.

② In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environment temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state)

③ Do not operate in a high magnetic field .Circuit boards may be broken down by it.

④ This product is not designed as radiation hardened.

⑤ Use an original protection sheet on the product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color or properties of the polarizer.

### 9.3.3 Characteristics

**The following items are neither defects nor failures.**

① Response time, luminance and color may be changed by ambient temperature.

②The LCD may be seemed luminance non-uniformity, flicker, vertical seam or small spot by display patterns.

③Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating time ,and especially low temperature, because the LCD has cold cathode fluorescent lamps.

④Do not display the fixed pattern for a long time because it may cause image sticking .Use a screen saver, if the fixed pattern is displayed on the screen.

⑤The display color may be changed by viewing angle because of the use of condenser sheet in the backlight.

⑥Optical characteristics may be changed by input signal timings.

⑦The interference noise of input signal frequency for this product and luminance control frequency of customer's backlight inverter may appear on a display. Set up luminance control frequency of backlight inverter so that the interference noise doses not appear.

### 9.3.4 Other

①All GND and VCC terminals should be used without a non-connected line.

②Do not disassemble a product or adjust volume without permission of SCO.

③Pay attention not to insert waste materials inside of products, if customer uses screw nails.

④Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to SCO for repair and so on .

⑤Not only the module but also the equipment should be packed and transported as the module. becomes vertical .Otherwise, there is the fear that a display dignity decreases by an impact or vibrations.

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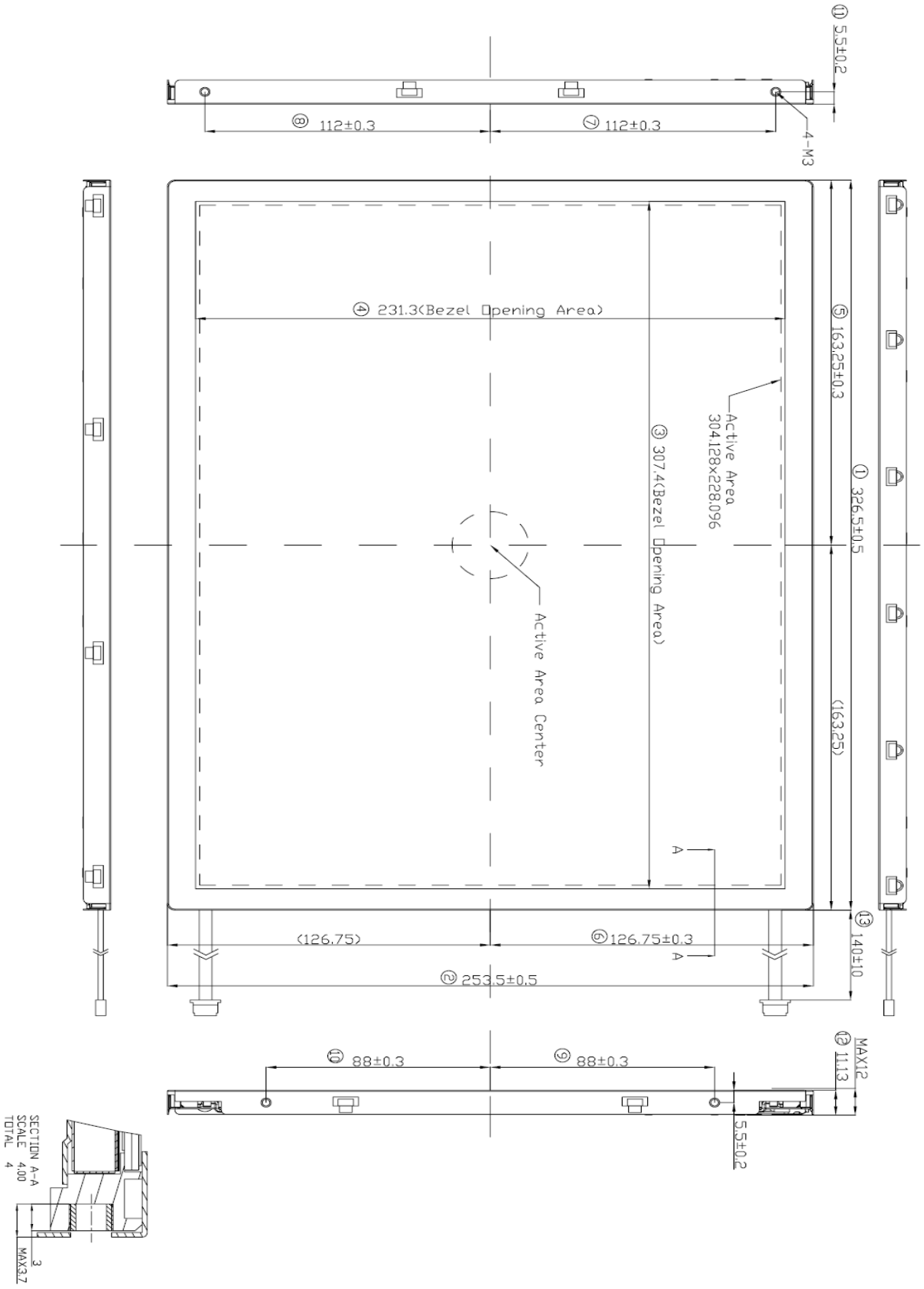
# 10.OUTDRAWING

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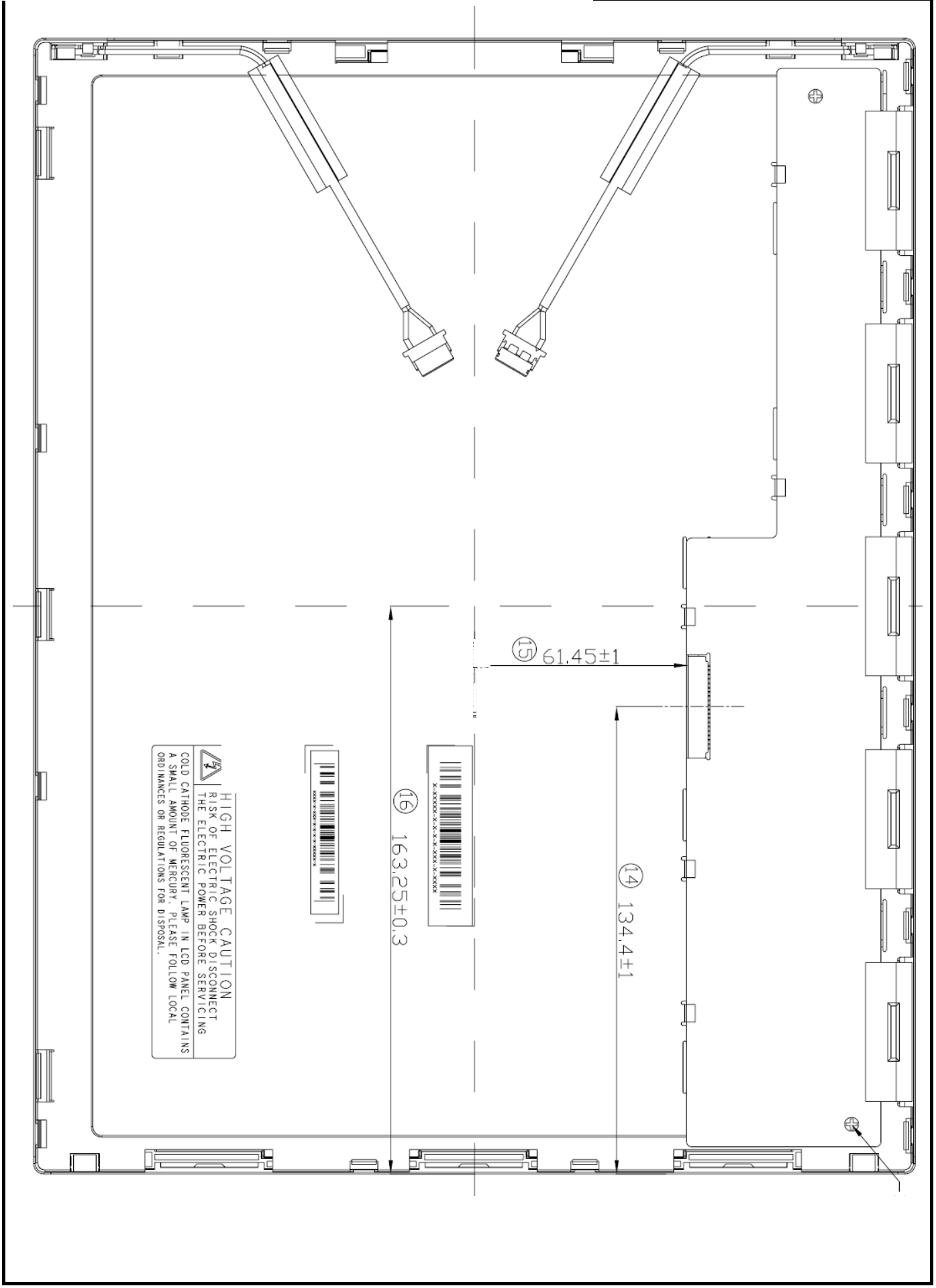


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